

ATMOSPHERIC REMOTE SENSING BY BALLOON-BORNE SOLAR ABSORPTION FTIR SPECTROMETRY

G. C. Toon, J. F. Blavier, L. Sen and J. T. Szeto

Jet Propulsion Laboratory,
California Institute of Technology
Pasadena, California 91109

Abstract.

Solar absorption spectra covering the 600 to 5700 cm^{-1} spectral region were measured during seven recent mid-latitude balloon flights of the MkIV interferometer, a high resolution (0.01 cm^{-1}) FTIR spectrometer built at the Jet Propulsion Laboratory. The MkIV instrument is similar to the ATMOS experiment, which has flown 3 times on the Shuttle, but employs two detectors (a HgCdTe photoconductor covering 600 to 1950 cm^{-1} , and an InSb photodiode covering 1850 to 5700 cm^{-1}) in parallel to measure the entire mid-infrared simultaneously. This arrangement not only provides the capability to measure a large number of different gases, but also produces spectra with good signal-to-noise ratio and linearity.

Spectra obtained during balloon ascent and from float altitude (39 km) during sunset and sunrise have been analyzed in order to determine vertical profiles of several gaseous atmospheric constituents including H_2O , HDO , O_3 , N_2O , CO , CH_4 , NO , NO_2 , N_2O_5 , HNO_3 , HNO_4 , ClNO_3 , HOCl , HCl , H_2O_2 , HF , COF_2 , CH_3Cl , CCl_4 , CFCl_3 , CF_2Cl_2 , CHFCl_2 , OCS , HCN , C_2H_6 , O_2 , N_2 , and CO_2 . The last three gases, having well known atmospheric vmr profiles, are important in establishing the true geometry of each spectrum, which otherwise is a major source of uncertainty. CO_2 lines having high excitation energies are also important for determining the temperature profile. The interpretation of the retrieved gas abundance profiles is greatly simplified by the fact that they are all measured simultaneously in the same airmass.

The observation strategy will be described along with examples of spectra. The data reduction methods will be explained with particular emphasis on the spectral fitting and the retrieval of under-determined gas vmr profiles.